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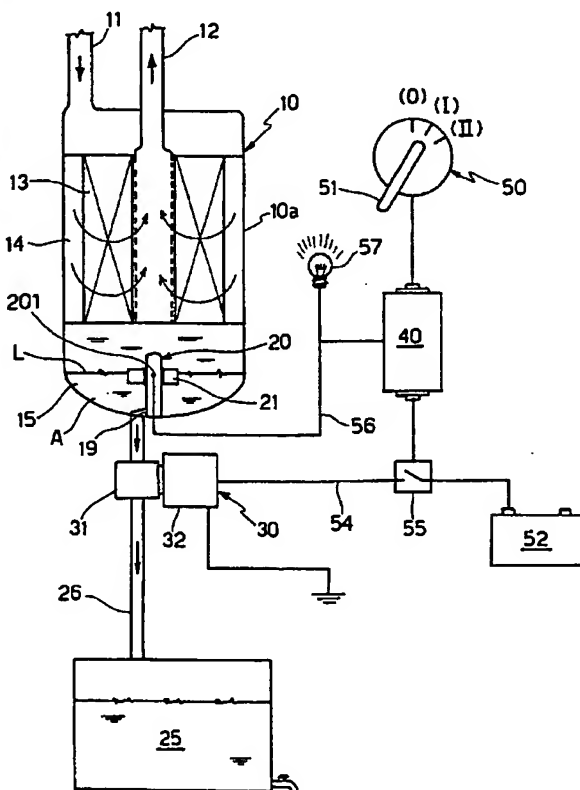
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[Continued on next page]

(54) Title: UNIT FOR AUTOMATICALLY BLEEDING OFF THE WATER WHICH SEPARATES IN A VEHICLE FUEL FILTER, IN PARTICULAR FOR DIESEL ENGINES



(57) Abstract: The unit comprises a sensor means (20) positioned in the collection chamber (15) to undergo activation when the water level reaches a predetermined maximum value; there is also provided an electrically operated withdrawal device (30) connected to the vehicle electrical system, to withdraw the water separated within the collection chamber through the bleed outlet (19), or to close said outlet; a microprocessor (40) is also provided, connected to said sensor means (20) and to the switch means (50) of the vehicle electrical power system, to electrically power the withdrawal device (30) when the sensor means (20) is activated and the ignition key (51) is in a first activation position (I).

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CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published:**

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

- 1 -

Description

UNIT FOR AUTOMATICALLY BLEEDING OFF THE WATER WHICH SEPARATES IN A  
VEHICLE FUEL FILTER, IN PARTICULAR FOR DIESEL ENGINES

Technical field

- 5 This invention relates to a unit for automatically bleeding off  
the water which separates in a vehicle fuel filter, in particular  
for diesel engines, and is applied to a vehicle the electrical  
system of which has a switch means operated by the ignition key  
and having a first activation position in which the system is  
10 activated but the engine remains switched off.

Background art

The fuel in motor vehicles is usually filtered before being fed to  
the engine.

- 15 As the water present in the fuel tends to damage by oxidation the  
metal parts with which it comes into contact, it has been known  
for some time to use filters, in particular for diesel engine fuel  
(gasoil), which besides removing the impurities separate the water  
parts present in the fuel.
- 20 As the water has a higher specific gravity than the fuel, it  
collects on the bottom of a chamber positioned in the lower part  
of the filter.

This water has to be bled off when it reaches a maximum level, to  
prevent it interfering with the proper operation of the filter,

- 25 but is sometimes returned to the fuel stream leaving the filter.  
In some filters a device is provided to visually indicate, on the  
vehicle dashboard, the attainment of said maximum level.

- The bleeding operation is carried out manually by opening an  
appropriate outlet port provided on the base of the collection  
30 chamber, this operation having necessarily to be effected with the  
engine switched off; otherwise, given that the filter operates  
under either vacuum or pressure, opening the discharge port would  
create unbalance in its interior, which would prevent correct  
bleeding of the water and would also cause malfunction of the

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filter itself (water drawn towards the engine or fuel expelled through the discharge).

The bleeding operation is very uncomfortable because, when the warning lamp lights, the driver has to stop the vehicle, descend  
5 from it, gain access to the filter (typically positioned in the engine compartment), open the bleed outlet and wait for the water to descend, which can require a relatively long time, especially if the filter operates under vacuum.

The main object of the present invention is to automatically  
10 effect bleeding in order to avoid said relatively lengthy and uncomfortable manual operations.

#### Disclosure of the invention

This and further objects are attained by the invention as  
15 characterised in the claims.

The invention is based on the fact of comprising:

a sensor means positioned in the collection chamber to undergo activation when the water level reaches a predetermined maximum value;

20 an electrically operated withdrawal device connected to the vehicle electrical system, to withdraw the water separated within the collection chamber through the bleed outlet, or to open and close said outlet;

a microprocessor connected to said sensor means and to the vehicle  
25 electrical power system, to make the connection between the vehicle battery and the withdrawal device in order to operate this latter, when the sensor means is activated and the ignition key is in a first activation position.

It should be noted that vehicles already comprise a connector to  
30 be connected to known filters comprising a water level sensor. Because of the presence of said connector, the invention enables a disposable filter to be produced, the shell of which can be provided with, or associated with, processor-operated water withdrawal means or water discharge means powered by the vehicle  
35 electrical system and connected by the existing connector to the control means on the vehicle.

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The pump unit or the water discharge means can be permanently associated disposably with the filter shell, or be permanently fixed to the vehicle and easily fitted into the shell.

The invention is described in detail hereinafter with the aid of  
5 the accompanying figures which illustrate one embodiment thereof by way of non-limiting example.

Figure 1 is a schematic illustration of the unit of the invention. Figure 2 is a more detailed partly sectional view of the filter and of some elements of the unit of Figure 1.

10 The unit of the invention is applied to a filter 10, substantially of known type, having an inlet 11 and outlet 12 and a filter means 13 positioned in an upper chamber 14. The fuel enters the chamber 14 through the inlet and, after passing through the filtering means 13, leaves through the outlet 12.

15 Below the chamber 14 and communicating therewith there is positioned a chamber 15 separated from the first by a perforated base; the chamber 15 serves for collecting the water separated from the fuel by the filtering means 13 (or by other devices). The entire chamber 15 is hence full, containing fuel in its upper  
20 part and separated water which accumulates in its lower part. The filter 10 comprises a casing 10a containing at least one filtering means 13, the collection chamber 15 and part of the water level sensor. According to the invention, a sensor means 20 is positioned in the collection chamber 15 to be activated when  
25 the water level reaches a set maximum value.

In particular, the sensor means 20 comprises a float 21, the specific gravity of which lies between the specific gravity of the water and that of the fuel, and which is positioned in the collection chamber under the influence of the level of the water A  
30 which collects on the bottom; in detail, the float 21 is slidable along a vertical guide stem 22, which projects into the chamber 15 by passing through a lower port 16 positioned at the lowest point of the chamber 15 and closed by the stem 22 itself.

In the upper portion of the stem 22 there is positioned a sensor  
35 element 201 (for example of magnetic reed type) which is activated when the float 21, in moving upwards as the level L of the

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accumulated water gradually increases, arrives at the element 201 which closes a contact and emits an electric signal.

Below the chamber 15 there is connected to the filter 10 an electrically operated withdrawal device 30 arranged to withdraw  
5 the separated water from the collection chamber 15 through a bleed outlet 19 provided along the stem 22.

In particular, in the embodiment shown in the figures, said withdrawal device comprises a pump 31 operated by an electric motor 32 to draw the water from the collection chamber 15 and to  
10 feed it through a pipe 26 to a collection vessel 25 mounted on the vehicle.

Preferably, the motor 32 and pump 31 are grouped together and enclosed in a container 33 which is fixed to the lower end of the filter 10 at the port 16, and to which the lower end of the stem  
15 22 is also fixed.

The unit of the invention is applied to a vehicle having a usual electrical system to which it is connected by the connector 43a, 43b, and which comprises a switch means 50 operated by the ignition key 51 having a deactivation position (0), a first  
20 activation position (I) in which the system is activated whereas the engine remains switched off, and finally a second activation position (II) in which the starter motor is operated.

The electric motor 32 is connected to the accumulator 52 of the electrical system, in particular via a circuit 54 comprising a  
25 switch 55.

The unit of the invention comprises a microprocessor 40 which is connected to the sensor means 20 via a circuit 56, and to the switch means 50 of the vehicle electrical system, and which also controls the switch 55 to make and break the connection between  
30 the battery 52 and the motor 32 of the pump 31. The microprocessor 40 is arranged to make the connection between the battery 52 and the motor 32 when the sensor means 20 is activated and the ignition key 51 is positioned in said first activation position (I).

35 When activated, the sensor means 20 produces a signal which, besides being fed to the microprocessor 40, activates a visual

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signal (warning lamp) positioned on the vehicle instrument panel (dashboard).

The motor 32 and pump 31 are grouped together to form a single assembly with the microprocessor 40, all being enclosed within the  
5 container 33, which is screwed to the lower port 16 of the filter cartridge.

The float 21 forms part of the replaceable filter cartridge, and is enclosed and guided by a cylindrical wall 23 fixed upperly to the perforated base 17. In contrast, the vertical guide stem 22  
10 is rigid with the assembly enclosed by the container 33 and projects into the collection chamber 15 by passing through the lower port 16 of the chamber 15, to close the port 16. When the assembly enclosed within the container 33 has been fixed to the filter 10 via the port 16, the float 21 is mounted on the stem 22  
15 and subjected to the influence of the level of the water which collects on the bottom of the collection chamber 15, and is arranged to emit a signal when said level reaches a predetermined maximum value. The unit enclosed within the container 33 is provided with a male electrical connector element 43a suitable for  
20 connection to a female connector element 43b, usually present on the vehicle for connecting the microprocessor to the vehicle electrical system.

While the level of the water A is less than a predetermined value, the sensor means 20 remains inactive and no signal reaches the  
25 microprocessor 40.

When said level reaches a predetermined maximum value, the float 21 rises to excite the sensor element 201, which feeds a signal to the microprocessor 40 and also lights the warning lamp 57. If at this point the vehicle engine is running, the microprocessor 40  
30 produces no effect on the filter as bleeding has to take place with the engine switched off.

However when the vehicle engine is at rest, moving the key 51 into position (I) merely activates the electrical system but without switching the engine on, and hence the warning lamp 57 also  
35 lights.

At this point the microprocessor 40 automatically closes the

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switch 55, to connect the battery 52 to the motor 32, which therefore operates the pump 31 so that this bleeds the water from the chamber 15 and feeds it to the vessel 25.

The connection between the battery 52 and the motor 32, for  
5 operating the pump 31, is maintained for a predetermined time period (for example 20 seconds), such as to enable all or nearly all the water collected in the chamber 15 to be bled off. While the pump 31 is in operation, the microprocessor 40 inhibits any command within the vehicle electrical system aimed at switching on  
10 the vehicle engine.

on termination of said time period, the microprocessor 40 again causes the switch 55 to open and halt the pump, and also resets the system. At this point the vehicle electrical system is released in the sense that the vehicle engine can be switched on.  
15 In a different embodiment (not shown in the figures), usable if the filter 10 operates with fluid under pressure, the withdrawal device 30 comprises a normally closed solenoid valve applied to the bleed outlet 19, and connected to the vehicle battery 52 via said switch 55 operated by the microprocessor 40. When activated,  
20 this solenoid valve opens the bleed outlet 19, and then bleeds the water from the chamber 15 by virtue of the pressure present in the chamber.

The invention is suitable for further useful applications in addition to the aforesaid.

25 In this respect, it possesses the special characteristic of controlling the water bleed remotely, hence the invention can also be located in vehicle positions which are normally inaccessible.

For example, it is well known that a considerable quantity of  
30 water separates from the fuel directly within the fuel tank, and sometimes directly arrives at the fuel filter.

If desired, the invention enables water separator means to be inserted directly into the fuel tank upstream of the pump which feeds the fuel to the engine filter, and to automatically withdraw  
35 at intervals the separated water from said means in the aforesaid manner.



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In this manner the quantity of water contained in the fuel reaching the engine filter is reduced to the extent of considerably lengthening the time period between one and the next engine filter bleed operation.

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Claims

1. A unit for automatically bleeding off the water which separates in a vehicle fuel filter, in particular for diesel engines, the vehicle having a switch means operated by the ignition key and having a first activation position in which the system is activated but the engine remains switched off, the filter (10) having a separated water collection chamber (15) provided with a bleed outlet (19); comprising:  
a sensor means (20) positioned in the collection chamber to undergo activation when the water level reaches a predetermined maximum value;  
an electrically operated withdrawal device (30) connected to the vehicle electrical system, to withdraw the water separated within the collection chamber through the bleed outlet, or to close said outlet;  
a microprocessor (40) connected to said sensor means (20) and to the switch means (50) of the vehicle electrical power system, to electrically power the withdrawal device (30) when the sensor means (20) is activated and the ignition key is in a first activation position (I).
2. A unit as claimed in claim 1, characterised in that the withdrawal device (30) is electrically powered to operate for a predetermined time period, sufficient to enable all the water collected in the chamber to be bled off.
3. A unit as claimed in claim 1, characterised in that the withdrawal device (30) is connected to a collection vessel (25) mounted on the vehicle, to which the bled water is fed.
4. A unit as claimed in claim 1, characterised in that the withdrawal device (30) comprises a pump arranged to draw the water from the collection chamber, and operated by an electric motor connected to the electrical supply via a switch (55) operated by the microprocessor.

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5. A unit as claimed in claim 1 applied to a filter which operates with fluid under pressure, characterised in that the withdrawal device (30) comprises a normally closed solenoid valve connected to the electrical supply via a switch operated by the  
5 microprocessor, to open the bleed outlet for water evacuation from the collection chamber.

6. A unit as claimed in claim 1, characterised in that said water level sensor means, when activated, produces a visual signal  
10 positioned on the vehicle.

7. A unit as claimed in claim 1, characterised in that while the withdrawal device (30) is in operation, the microprocessor (40) inhibits any command within the vehicle electrical system  
15 aimed at switching on the vehicle engine.

8. A unit as claimed in claim 1, in which the filter comprises, in a single disposable container, a filtering means, (13), the collection chamber (15), and a part (21) of the water  
20 level sensor, characterised in that the withdrawal device (30), the microprocessor (40) and the other part (22) of the water level sensor are enclosed in a single casing which is fixed, by screwing, to the lower port of the collection chamber of the filter cartridge, and is provided with a connector means for its  
25 electrical connection to the vehicle electrical power system.

9. A unit as claimed in claim 8, characterised in that the sensor means comprises, positioned in the collection chamber, a float, the specific gravity of which lies between the specific  
30 gravity of the water and that of the fuel, and a float guide stem (22), rigidly joined to the assembly formed by the withdrawal device and the microprocessor, and projecting into the chamber (15) by passing through the lower port of the chamber 15 and closing this port.

**AMENDED CLAIMS**

[received by the International Bureau on 4 April 2001 (04.04.01);  
original claims 1-9 replaced by new claims 1-11 (3 pages)]

Claims

5 1. A unit for automatically bleeding off the water  
which separates in a vehicle fuel filter (10), the  
vehicle having a switch means operated by the ignition  
key and having a first activation position in which the  
system is activated but the engine remains switched  
10 off, the unit consisting of a first single disposable  
container comprising a separated water collection  
chamber (15) provided with a bleed outlet (19); a  
filtering means (13), and one part of water level  
sensor means (20); and of a second single container  
15 comprising the other part of the water level sensor  
means (20); said unit further comprising an  
electrically operated withdrawal device (30) connected  
to the vehicle electrical system, to withdraw the water  
separated within the collection chamber through the  
20 bleed outlet, or to close said outlet, and a  
microprocessor (40) connected to said sensor means (20)  
and to the switch means (50) of the vehicle electrical  
power system, to electrically power the withdrawal  
device (30) when the sensor means (20) is activated and  
25 the ignition key is in a first activation position (I).

2. A unit as claimed in claim 1, characterised in  
that the one part of the water level sensor means (20)  
comprises a float (21), the specific gravity of which  
lies between the specific gravity of the water and that  
30 of the fuel.

3. A unit as claimed in claim 1, characterised in that the other part of the water level sensor means (20) comprises a float guide stem (22), rigidly joined  
5 to an assembly formed by a withdrawal device and a microprocessor, and projecting into the collection chamber (15) by passing through the lower port of the collection chamber (15) and closing this port.

4. A unit as claimed in claim 3, characterised in  
10 that the withdrawal device and the microprocessor are contained in said first single casing, that comprises connector means for its electrical connection to the vehicle electrical power system.

5. A unit as claimed in claim 1, characterised in  
15 that the sensor means (20) positioned in the collection chamber undergoes activation when the water level reaches a predetermined maximum value.

6. A unit as claimed in claim 1, characterised in that the withdrawal device (30) is electrically powered  
20 to operate for a predetermined time period, sufficient to enable all the water collected in the chamber to be bled off.

7. A unit as claimed in claim 1, characterised in that the withdrawal device (30) is connected to a collection  
25 vessel (25) mounted on the vehicle, to which the bled water is fed.

8. A unit as claimed in claim 1, characterised in that the withdrawal device (30) comprises a pump arranged to draw the water from the collection chamber, and  
5 operated by an electric motor connected to the electrical supply via a switch (55) operated by the microprocessor.

9. A unit as claimed in claim 1 applied to a filter which operates with fluid under pressure, characterised  
10 in that the withdrawal device (30) comprises a normally closed solenoid valve connected to the electrical supply via a switch operated by the microprocessor, to open the bleed outlet for water evacuation from the collection chamber.

15 10. A unit as claimed in claim 1, characterised in that said water level sensor means, when activated, produces a visual signal positioned on the vehicle.

11. A unit as claimed in claim 1, characterised in that while the withdrawal device (30) is in operation, the  
20 microprocessor (40) inhibits any command within the vehicle electrical system aimed at switching on the vehicle engine.

**STATEMENT UNDER ARTICLE 19(1) – RULE 46.4****PCT / IB 00 / 01527**

| <b><u>AMENDED CLAIMS</u></b>  | <b><u>ORIGINAL CLAIMS</u></b>              |
|---|--|
| 1 derives from original claim 1 to which some of the limitations of the original claim 8 have been added.<br>The new wording FIRST SINGLE DISPOSABLE CONTAINER has been substituted for SINGLE DISPOSABLE CONTAINER; the new wording SECOND SINGLE CONTAINER has been substituted for SINGLE CASING | 8 cancelled                                |
| 2 consists of a part of the original claim 9  | 9 cancelled                                |
| 3 consists of a part of the original claim 9  |  |
| 4 consists of a part of the original claim 8  |  |
| 5 consists of a part of the original claim 1  |  |
| 6 to 11 correspond to the original claims 2 to 7  | 2 to 7 renumbered as amended claim 6 to 11 |

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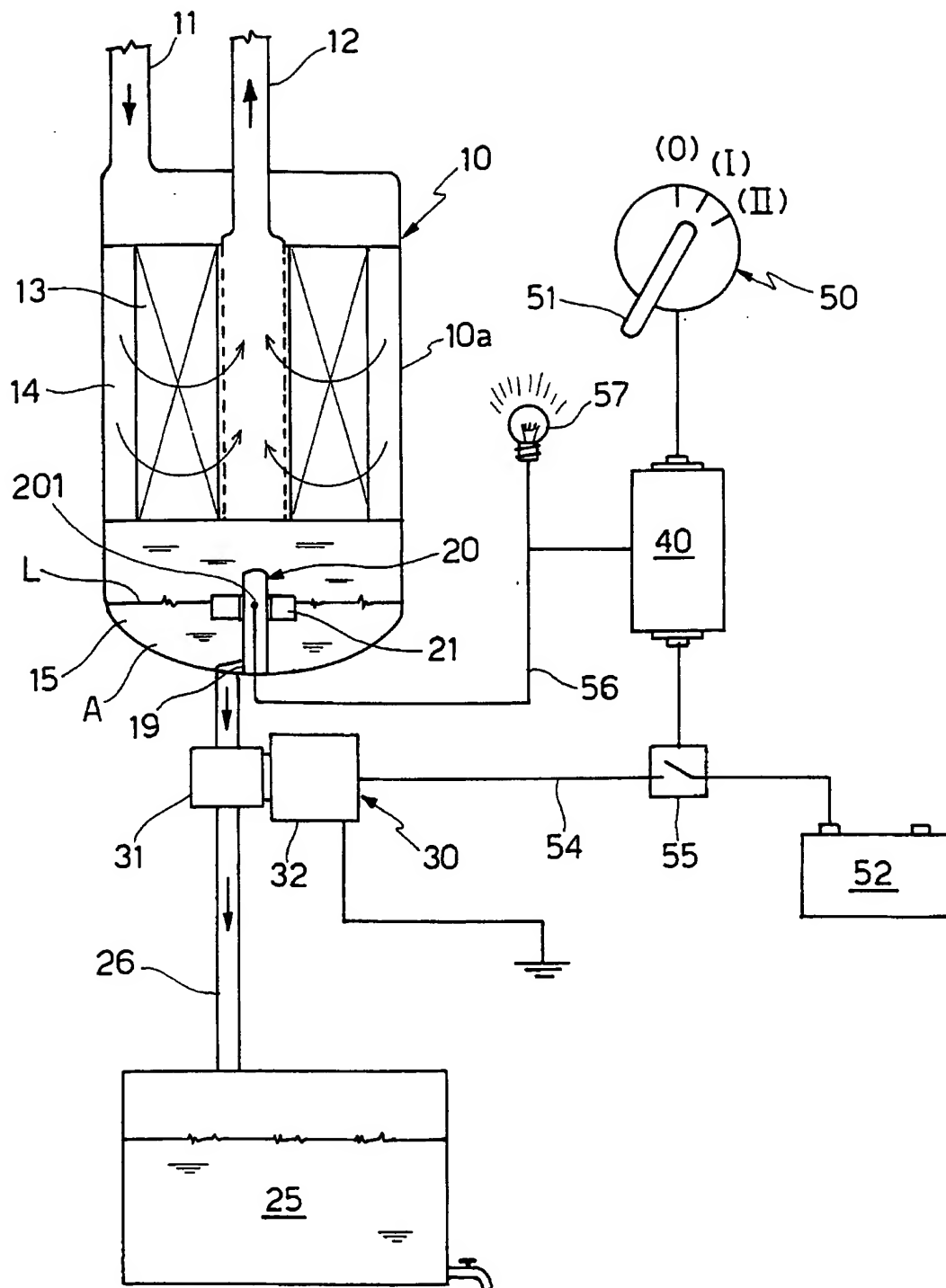
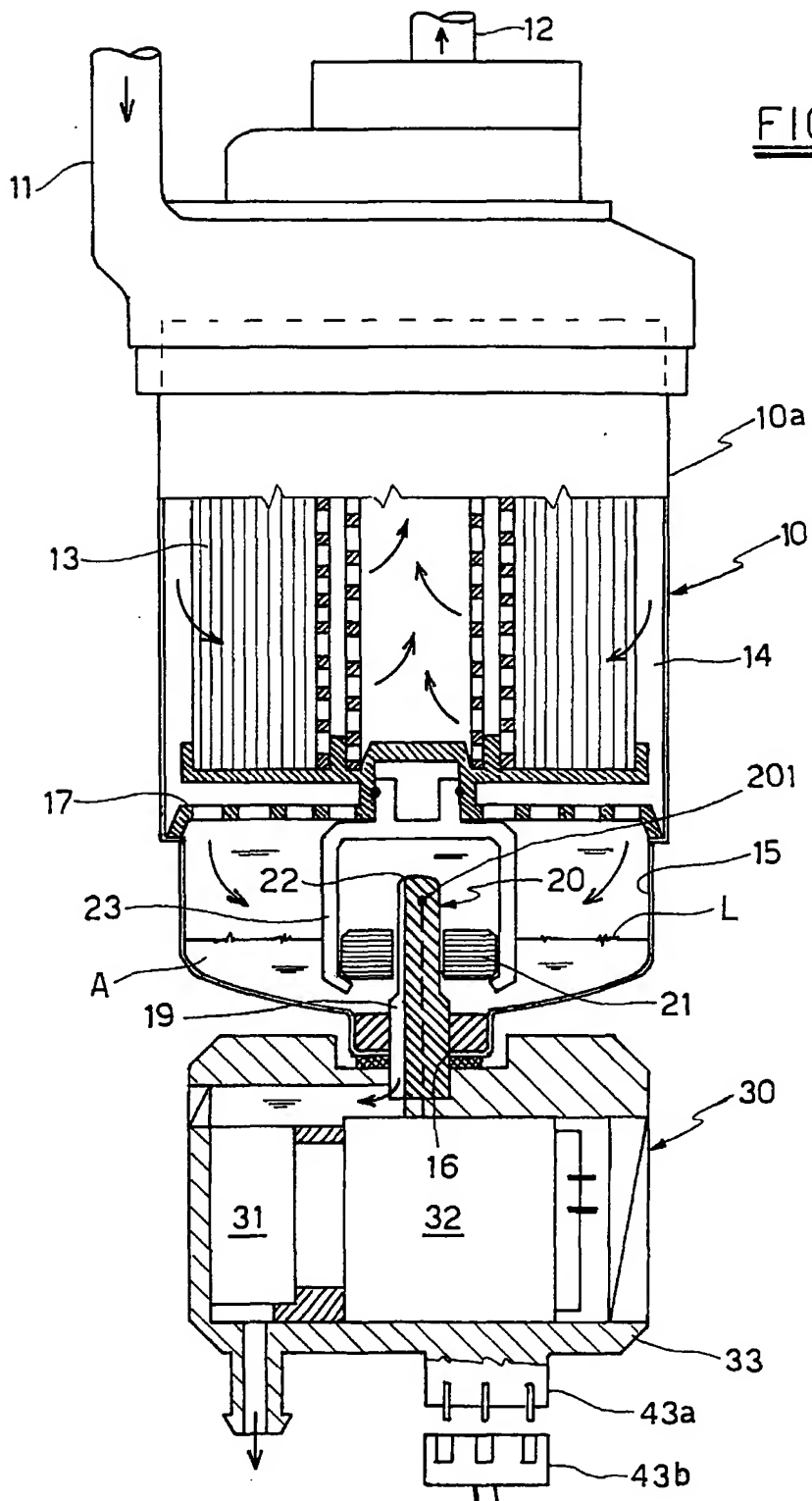


FIG.1



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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/01527

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 F02M37/22 B01D36/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F02M B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|------------|--|-----------------------|
| X          | EP 0 337 861 A (LABINAL)<br>18 October 1989 (1989-10-18)<br>abstract<br>column 1, line 51 - column 2, line 28<br>column 3, line 5 - line 39<br>column 3, line 53 - column 5, line 10<br>column 5, line 35 - line 58; figure 1<br>--- | 1,2,4,6,<br>7         |
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

1 February 2001

Date of mailing of the international search report

07/02/2001

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/01527

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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| A          | <p>GB 2 065 336 A (STUART)<br/> 24 June 1981 (1981-06-24)<br/> page 1, line 8 - line 15<br/> page 3, line 2 - line 20<br/> page 3, line 28 - line 58<br/> page 3, line 77 - line 103<br/> page 3, line 128 -page 4, line 10<br/> page 4, line 30 - line 33; figure 1</p> | 1,2,4,5,<br>8         |
| A          | <p>DE 44 09 570 A (MERCEDES-BENZ)<br/> 24 May 1995 (1995-05-24)<br/> column 2, line 12 - line 20<br/> column 2, line 29 - line 46<br/> column 2, line 62 -column 3, line 12</p>  | 1,5                   |

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Information on patent family members

International Application No

PCT/IB 00/01527

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